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VALUE FOR SMALL DIAMETER STUMPAGE AFFECTED BY PRODUCT PRICES, PROCESSING EQUIPMENT, AND VOLUME MEASUREMENT

[*timber]

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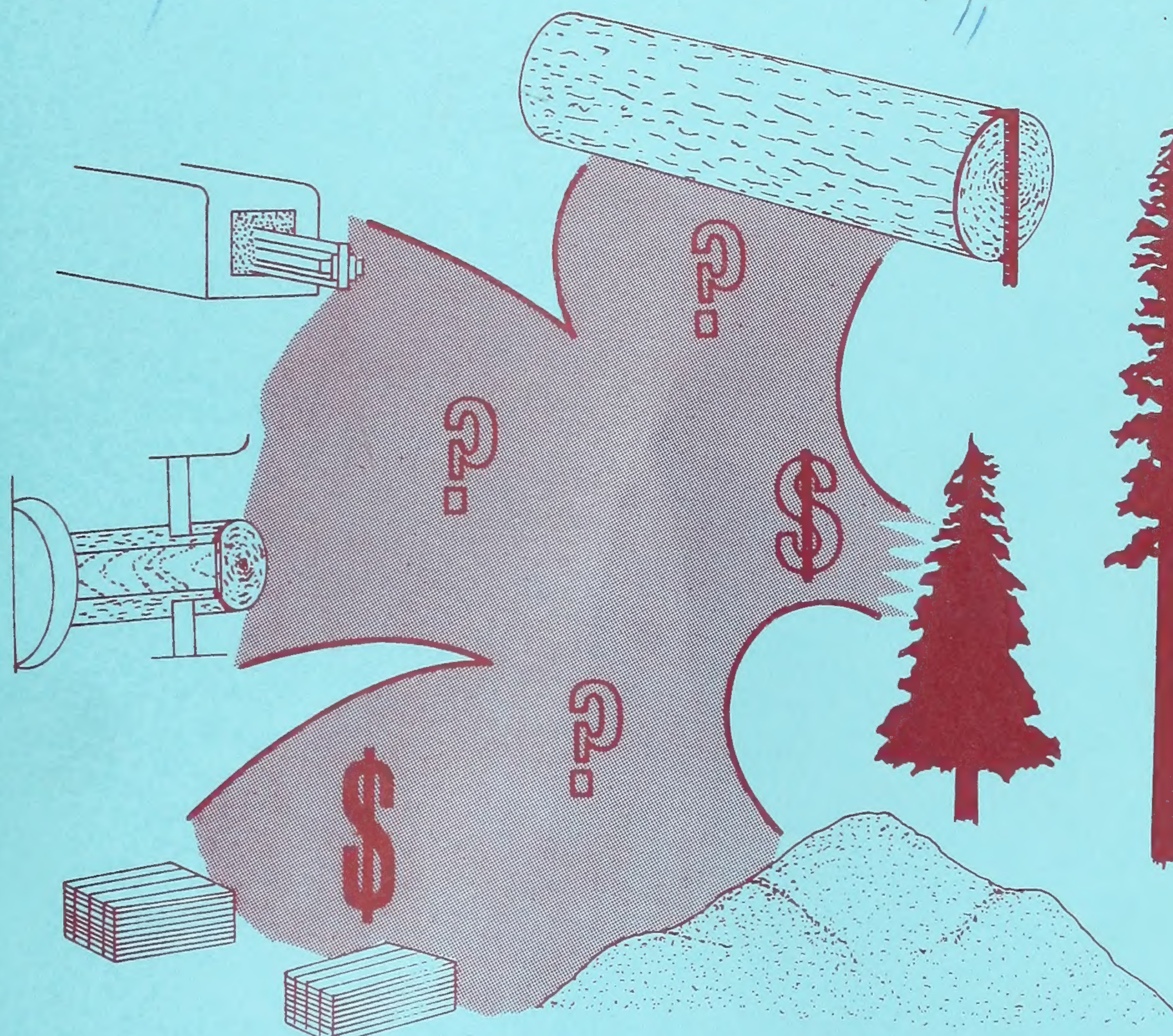

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ABSTRACT

Factors that affect the stumpage price for small diameter timber can affect utilization and land management options for this stumpage. Type of milling process and method of lumber pricing and log volume determination were found to have potential for affecting price of small diameter stumpage. From existing cost, price, and product recovery data, the study shows that a Chip-N-Saw operator could pay up to $15.40 per thousand board feet, Scribner scale, more for stumpage than could a band mill sawing similar products. Standard and better lumber pricing rather than pricing by individual grade reduced the margin available to bid for stumpage. Scribner scale consistently had less volume than International scale. Cubic volume measurements were in all cases more precise as predictors of lumber tally than either International or Scribner scale. Relating log diameter to recovery factor consistently improved the accuracy of the prediction. This was true for both Forest Service and Scaling Bureau measurements. These factors should be considered by the land manager and timber purchaser when they evaluate management options sensitive to stumpage price.

KEYWORDS: Stumpage price, technology, forestry business economics.

INTRODUCTION

Forest management practices such as commercial thinning in the Pacific Northwest are increasing the volume of available smaller diameter timber. The stumpage price for this timber affects both utilization and land management options for the stumpage. For example, stumpage price and the value recovered from stumpage determine the handling costs that the processor can absorb for the timber; and the economic feasibility of commercial thinning operations depends directly on stumpage price.

Although many factors affect stumpage price, factors which should be of special interest to land managers and timber processors faced with an increasing volume of smaller diameter timber are the development of new processing technologies, the method of pricing product output, and the method used to measure log volume.

New specialized processing technologies are being developed in response to the increased availability of small diameter timber. These new processes can influence the intrinsic value of standing timber if either processing costs or end product mix is affected by the processing technique.

Two means for lumber pricing are by individual grade and by standard and better pricing. Depending on the distribution of lumber output by grade for small-log mills, the method of lumber pricing has potential for affecting stumpage price.

In some cases, methods which are used to estimate old-growth timber volume are inadequate for small diameter timber. A reliable method for estimating timber volume is essential for orderly marketing of small diameter timber.

STUDY OBJECTIVES

The objectives of this study are to demonstrate the potential effect on small diameter stumpage value of

1. Different mill technologies
2. Alternative methods of product pricing
3. Alternative log rule and log measurement procedures.

The study procedure was to use existing data to determine the potential influence of these three factors on stumpage value when stumpage value is defined as the residual of end product selling value minus manufacturing and logging costs and a margin for profit and risk. The study was based in part on end product yield data from thinnings with a diameter b.h. range of 7-15 inches.

POTENTIAL EFFECT OF MILL TECHNOLOGY ON STUMPAGE VALUE

Two new methods of timber processing which have been developed specifically for handling small diameter timber are the Chip-N-Saw and the Beaver.[1/] These two types of mills are similar in that a profiled or squared cant is chipped from the log. In a conventional mill, such as band mill, a cant is sawn from the log and the resulting slabs can then be chipped. If we assume that logging and log transportation costs are the same regardless of manufacturing process, "conventional" stumpage values can be affected by these new processes only through variation in mix of end products and variation in mill processing costs.

End product yield data for three mills--a Chip-N-Saw, a Beaver, and a conventional band mill--using similar size and similar quality timber from the Mount Hood National Forest are shown in table 1. The samples were taken from well-stocked Douglas-fir stands less than 100 years old. The material processed at the Chip-N-Saw and the band mill was from the same stand. The material processed at the Beaver was from two widely separated stands. The Chip-N-Saw had a higher proportion of select structural output than either the Beaver or the band mill; but at all three mills, standard and better production accounted for over 90 percent of lumber output. As measured by the ratio of lumber output to volume of log input, net Scribner scale, the band mill (1.68) used a higher proportion of the log in lumber manufacture than did the Beaver

Table 1.--*Lumber and chip output of three small-log mills*

Product	Mill type					
	Beaver		Chip-N-Saw		Band	
	Board feet	*Percent*	*Board feet*	*Percent*	*Board feet*	*Percent*
Lumber:						
Standard and better						
Select structural	6,658	13.7	11,057	34.6	2,875	6.6
Construction	34,214	70.4	14,858	46.5	27,933	63.8
Standard	5,642	11.6	3,000	9.4	9,678	22.1
Utility	1,628	3.4	2,009	6.3	2,748	6.3
Economy	457	.9	1,002	3.2	525	1.2
Total	48,599	100.0	31,926	100.0	43,759	100.0
	Tons					
Chips	78		36		25	

Source: Fahey and Hunt (1972).

1/ *Mention of companies or products does not constitute endorsement by the U.S. Department of Agriculture.*

(1.38) or the Chip-N-Saw (1.39), and the latter two mills produced a higher proportion of chips. The ratio of tons of chip output per thousand board feet of lumber output was 1.6 for the Beaver, 1.1 for the Chip-N-Saw, and 0.6 for the band mill.

The product mix at each mill reflects in part the orders which each mill had on file at the time the study was conducted. Since prices are by grade, not by dimension, this should have little effect on end product values. A time series of lumber and chip price data were applied to the product mix at each mill to observe the influence of changing prices on relative end product selling values.[2/] Table 2 shows that at the beginning of the period 1960-70, the band mill had the highest combined lumber and chip selling value per thousand board feet, Scribner log scale. This advantage decreased over the decade because of the rapid increase in chip prices. The Beaver had the highest end product selling value in 1970, reflecting the change in chip value.

Table 2.--*Lumber and chip selling value by mill type, 1960-70*[1/]

(Dollars per thousand board feet, Scribner log scale)

Year	Mill type		
	Beaver	Chip-N-Saw	Band
1960	121.98	115.21	124.29
1961	121.04	113.78	121.83
1962	124.90	117.09	125.05
1963	128.50	120.16	127.94
1964	129.14	119.96	126.63
1965	130.35	120.44	125.85
1966	137.23	126.48	132.39
1967	143.92	132.57	138.79
1968	172.79	160.70	170.48
1969	176.94	163.93	171.80
1970	154.73	140.85	143.30

1/ Lumber was priced as select structural, construction, standard, utility, or economy, depending on grade.

Although cost data were not collected in this study, a study by Dobie (1967) in British Columbia showed that combined lumber and chip processing costs for a band mill were $25.66 per thousand board feet, mill tally, and the equivalent Chip-N-Saw costs were $18.17. If we apply recovery factors[3/]

2/ *The lumber price data were derived by a method developed by John H. Beuter (Stumpage appraisal under alternative assumptions of log use: a case study in the Douglas-fir subregion (unpublished Ph.D. thesis, 1966, on file at Iowa State University, Ames)); chip price data are from Hamilton (1971).*

3/ *The recovery factor is realized lumber tally divided by measured log volume.*

from our study, band mill costs would be $43.11 and Chip-N-Saw costs, $25.26 per thousand board feet, Scribner log scale, a difference of about $18. With 1970 prices and the end product selling values in table 2, the residuals after substracting manufacturing costs are $100.19 per thousand board feet for the band mill and $115.59 for the Chip-N-Saw. If mill costs are higher in Oregon and Washington, they should be correspondingly higher for both mill types.

Other things being equal, the Chip-N-Saw operator could pay up to $15.40 per thousand board feet more for stumpage than could the band mill. If some of this potential recovery differential is used to bid for small diameter timber, the increase in stumpage return would expand the economic feasibility of forest management activities such as thinning. Although recovery data and costs could be expected to vary by mill, this finding indicates that, under competitive conditions, the lower cost process could be expected to be adopted and firms with conventional mills would be forced to adjust their operations.

Processing cost data are not available for the Beaver. Similarities between the Beaver and the Chip-N-Saw suggest that costs are lower for the Beaver than for the band mill. If so, the Beaver would have the same potential as the Chip-N-Saw for affecting stumpage value.

POTENTIAL EFFECT OF METHOD OF PRODUCT PRICING ON STUMPAGE VALUE

All the lumber output of the three study mills was classified as economy, utility, standard, construction, or select structural. This output could be valued on the basis of one price for each grade or on the basis of prices for standard and better, utility, and economy grades. Prices for standard and better lumber grades (used in table 3) were based on U.S. Bureau of Labor Statistics (monthly) data. Prices for utility and economy grades were derived by a method developed by Beuter (see footnote 2), and chip prices were based on Hamilton (1971).

The comparisons of process in the previous section were based on lumber pricing by individual grade. For each process, the effect of standard and better pricing rather than pricing by grade is to decrease the end product selling value, as shown by comparison of table 2 with table 3. With 1970 prices, standard and better pricing reduced end product selling value $6.68 per thousand board feet, Scribner scale, for the Beaver, $10.05 for the Chip-N-Saw, and $3.83 for the band mill.

The effect of alternative end product pricing methods on end product selling value is dependent on the product mix which can vary by mill. This indicates that both mill operators and landowners should consider end product markets and local milling capabilities in formulating stumpage price expectations for small diameter timber.

Table 3.--*Lumber and chip selling value by mill type, standard and better lumber pricing, 1960-70*[1]

(Dollars per thousand board feet, Scribner log scale)

Year	Mill type		
	Beaver	Chip-N-Saw	Band
1960	115.60	105.85	118.32
1961	115.29	105.03	116.34
1962	118.96	108.17	119.20
1963	122.64	111.33	122.09
1964	123.22	111.05	120.86
1965	125.35	112.34	121.53
1966	130.84	117.07	126.34
1967	136.32	121.97	131.29
1968	167.57	152.18	167.13
1969	171.80	155.28	170.15
1970	148.05	130.80	139.47

1/ Lumber was priced as standard and better, utility, or economy, depending on grade.

POTENTIAL EFFECT OF LOG VOLUME ON STUMPAGE VALUE

In the previous discussion, Scribner log rule was used as a means of predicting the volume of lumber output. Scribner log rule is also commonly considered as a measure of log volume and was derived originally for logs 12 inches and larger in diameter. In recent years, public agencies and private landowners in the Pacific Northwest have experimented with other means for measuring the volume in small diameter timber. For examples, the Bureau of Land Management has used the International log rule in selected areas, and forest industry is using cubic volume measure on some lands. The log volume measure used for timber has no effect on the intrinsic value of the timber. However, if timber is sold in terms of price per unit of volume and if total volumes, as derived by various measures, differ, the values per unit of volume will correspondingly differ.

If we assume all costs are equal, differences in end product selling value per unit of log volume due to log volume measure would be reflected in stumpage value. Log input for the Beaver and the Chip-N-Saw was measured by the National Forest scaling handbook procedure and the uniform Scaling Bureau procedure.[4] For each procedure, log volume was measured by Scribner and International 1/4-inch log rules and by cubic volume. The Scribner and International 1/4-inch log rules predict lumber output in board feet. Cubic volume measure is an estimate of the cubic volume of the log and does not predict lumber recovery directly.

4/ *See Appendix A for a description of scaling procedures.*

The Bureaus' procedure was used for scaling woods-length logs. These same logs were transported to a mill and generally cut into shorter mill-length logs. The mill-length logs were scaled by the Forest Service procedure. Although log length differed between the woods and each mill, the same timber was involved at both locations.

Table 4 is based on a representative sample of logs at each chipping mill. At both mills, the Bureau procedure consistently produced higher end product selling values per unit of log volume for each log-volume measure than did the Forest Service procedure. Of the two board-foot measures, end product selling value per unit log scale was lower for the International 1/4-inch log rule than for Scribner for each measurement procedure at both mills.

The effect of lumber pricing and measurement methods is illustrated in table 4. With standard and better pricing and the Forest Service Scribner measurement procedure, the Beaver had a $26.17 per thousand board feet advantage over the Chip-N-Saw. With individual grade pricing and the Scaling Bureau measurement procedure, the Chip-N-Saw had a $6.09 per thousand cubic feet advantage over the Beaver.

Table 4.--*Lumber and chip selling value of logs by type of mill, measurement procedure, and lumber pricing method*

Mill and lumber pricing method	Forest Service measurement			Uniform Scaling Bureau measurement		
	Board feet		Cubic feet	Board feet		Cubic feet
	Scribner	International 1/4-inch		Scribner	International 1/4-inch	
	Dollars per thousand					
Beaver:						
Standard and better	130.21	92.72	542.45	149.21	99.39	566.84
By grade	136.60	97.28	569.11	156.54	104.28	594.70
Chip-N-Saw:						
Standard and better	104.04	83.27	500.34	133.41	88.86	556.07
By grade	112.41	89.96	540.58	144.15	96.00	600.79

Table 4 emphasizes the need for both timber buyers and sellers to be informed about the characteristics of alternative log rules and measurement procedures if they are to measure the intrinsic value of the timber. This need is further illustrated by the fact that for logs 9 inches and less in diameter, the Scribner rule predicts the same volume for 16- as for 20-foot-long logs. If buying by Scribner log scale, the timber purchaser would pay the same amount for 20-foot logs as for 16-foot logs if small end diameters were the same and less than 9 inches. A larger proportion of the logs sawn at the Beaver were 20-foot logs than was the case for the Chip-N-Saw, and the

Chip-N-Saw had a higher proportion of 16-foot logs (table 5). One effect of this was to increase the recovery ratio for the Beaver relative to the Chip-N-Saw and, in turn, the end product selling value per unit of log volume.

Table 5.--*Sample log input for two mills by log length, Forest Service measurement*

Log length (feet)	Mill	
	Beaver	Chip-N-Saw
	Number of logs	
10	0	2
12	7	32
14	6	40
16	23	138
18	5	18
20	170	76
22	4	1
24	59	1
26	4	0
Total	278	308

Which log volume measure is best for accurately predicting lumber recovery? This should be a consideration of both timber buyer and seller in setting a basis for payment. The six measurement procedure and log volume measure combinations were ranked using the coefficient of variation for the recovery factor as a measure of reliability. The log input and lumber output data at the Beaver and the Chip-N-Saw were combined by using covariance analysis for each combination.

When Bureau measurement rules were used, the arithmetic mean recovery factor was 5.78 for cubic log volume, 1.09 for the International 1/4-inch log rule, and 1.62 for the Scribner rule. The coefficient of variation was 25.8 percent for cubic, 39.3 percent for International 1/4-inch, and 41.3 percent for Scribner. The coefficient of variation is a measure of relative variation. For example, a coefficient of variation of 41.3 percent for Scribner compared with 25.8 percent for cubic volume means that the recovery factors for individual logs calculated by Scribner rule will vary more around the mean for all logs than will recovery factors calculated by cubic measure.

For the logs scaled by the Forest Service measurement system, the arithmetic mean recovery factor was 5.28 for cubic log volume, 0.98 for International 1/4-inch rule, and 1.27 for Scribner rule. The coefficient of variation was 27.6 percent for cubic, 36.7 percent for International, and 36 percent for Scribner.

Of the two board-foot rules, International 1/4-inch came closer in predicting actual lumber recovery as measured by the recovery factor. However,

the cubic measure showed the least variation in recovery factor. On the average, both timber buyer and seller would be better able to estimate the actual volume of lumber to be expected from a stand of timber if they used cubic log volume measure rather than the International 1/4-inch or the Scribner log rules.

Because of underlying assumptions about log taper, the recovery factor varies by diameter class, as shown in figures 1-3. Each figure shows recovery factor as a function of log diameter for a measurement procedure and a log volume measure for the Beaver and the Chip-N-Saw and for the two mills' combined log input and lumber output. Timber buyers generally use similar diameter-recovery factor curves in bidding for timber. The buyer makes an estimate of the diameter distribution of logs in the timber stand and applies a recovery factor, based on his experience, to the log scale estimates. This gives the buyer an estimate of the lumber recovery to be expected from the stand.

How much does the relationship between log diameter and the recovery factor help the timber buyer and timber seller to arrive at a reliable estimate of timber volume? The buyer and seller have an option of using an average recovery factor for all logs in the stand rather than a different recovery factor for each diameter class. A measure of the contribution of diameter to explanation of variation in the recovery factor is the reduction in the coefficient of variation which results when diameter is taken into account. In every case, accounting for diameter reduces the coefficient of variation (table 6). The effect is strongest for the International 1/4-inch rule and weakest for cubic. However, the coefficient of variation for cubic measurement without taking diameter into account was less than the coefficients for the Scribner and International 1/4-inch rules with diameter taken into account. This means that with the cubic volume measure, an average recovery factor could be applied to each log in the sample and the average variation between actual lumber yield and predicted lumber yield would be less than for Scribner and International 1/4-inch rule even if a recovery factor were to be applied to each diameter class with the latter two volume measures.

Table 6.--*Coefficient of variation for recovery ratio with and without log diameter taken into account, by log volume prediction and measurement procedure*

Log volume prediction	With diameter	Without diameter
Uniform Scaling Bureau procedure:		
Scribner rule, board feet	35.9	41.3
International 1/4-inch rule, board feet	30.4	39.3
Cubic volume	24.6	25.8
Forest Service procedure:		
Scribner rule, board feet	32.4	36.0
International 1/4-inch rule, board feet	28.0	36.7
Cubic volume	26.3	27.6

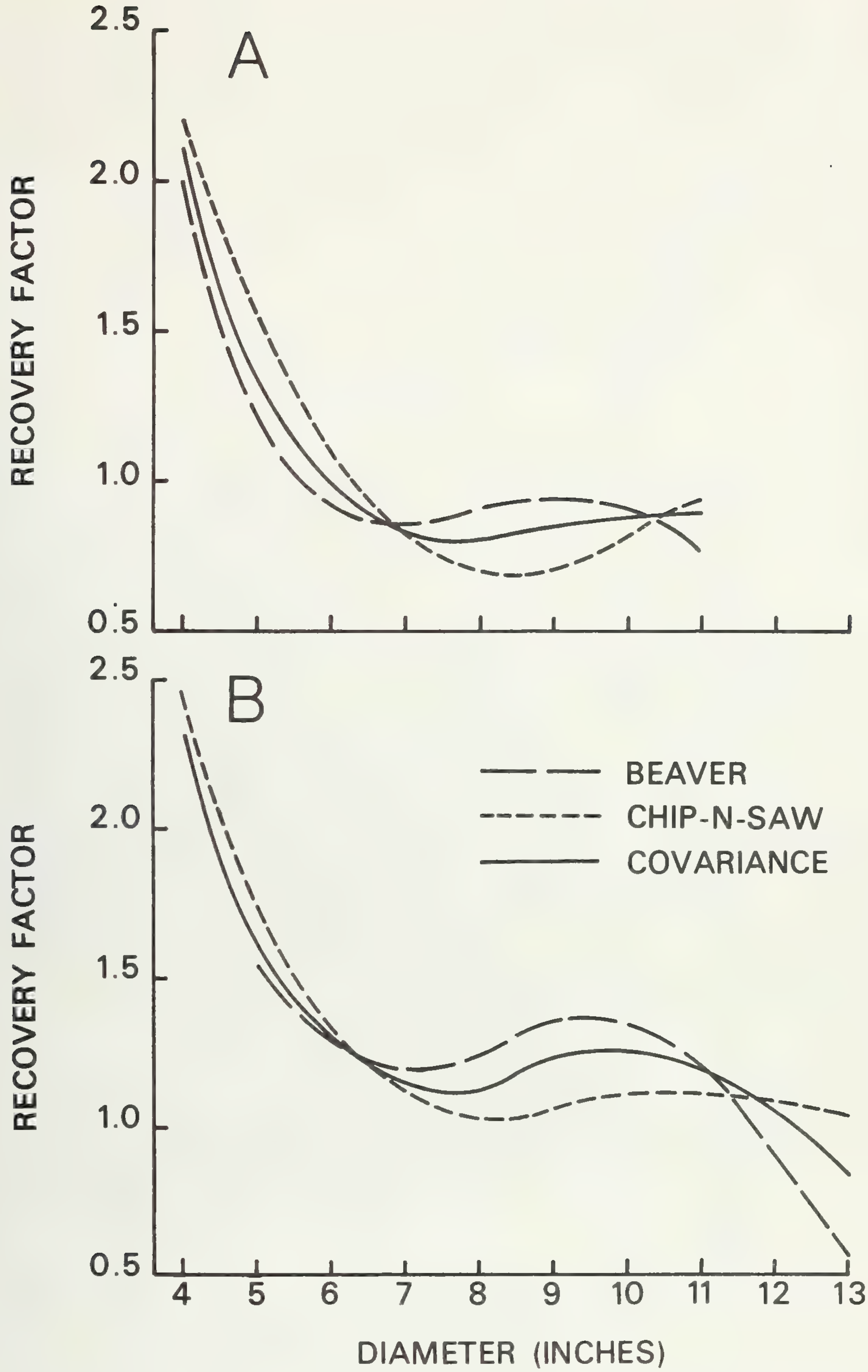

Figure 1.--Recovery factor, as a function of log diameter, by mill: A, *Uniform Scaling Bureau measurement system, Scribner scale;* B, *Forest Service measurement system, Scribner scale.*

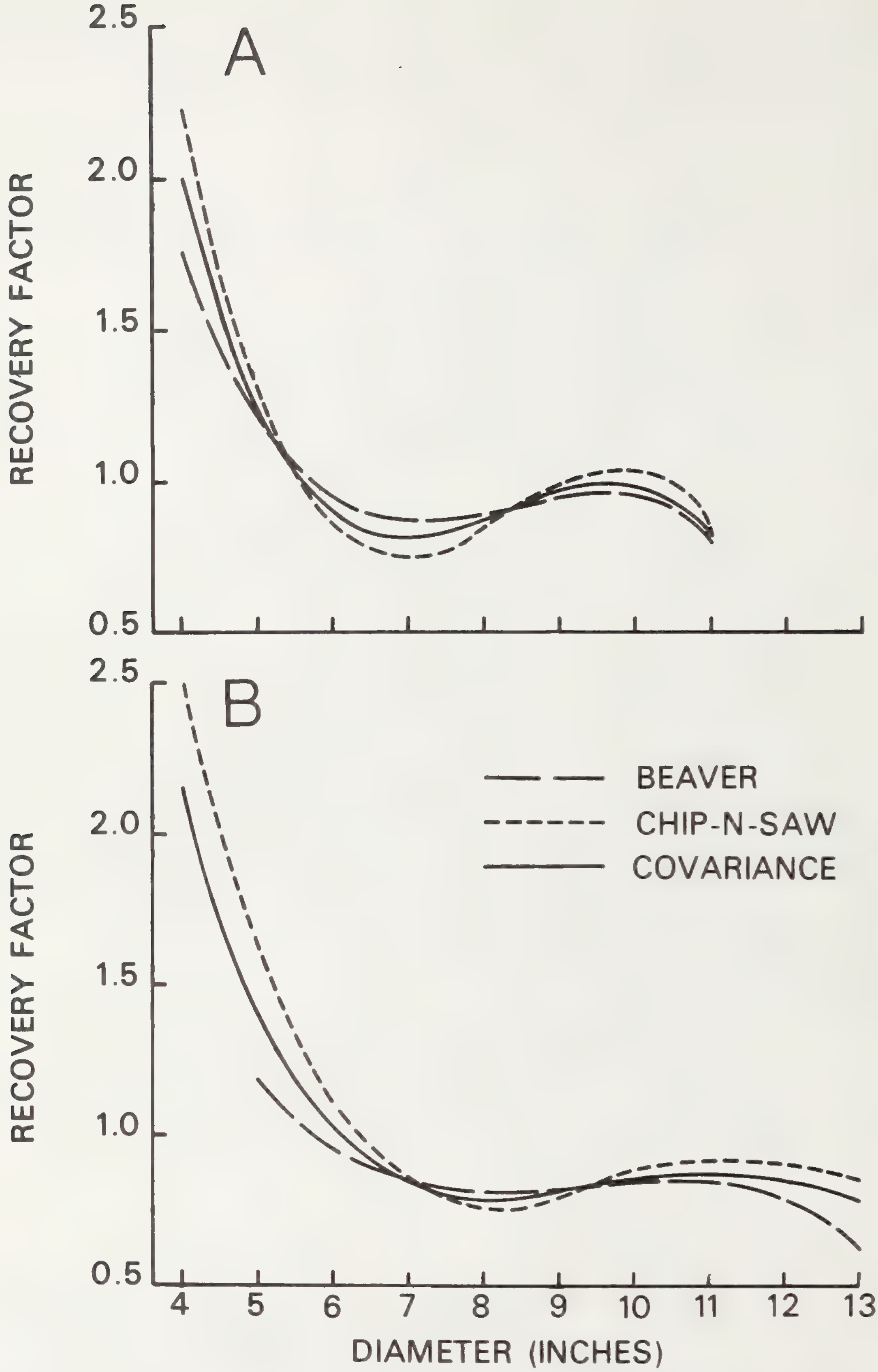

Figure 2.--Recovery factor, as a function of log diameter, by mill: A, Uniform Scaling Bureau measurement system, International 1/4-inch scale; B, Forest Service measurement system, International 1/4-inch scale.

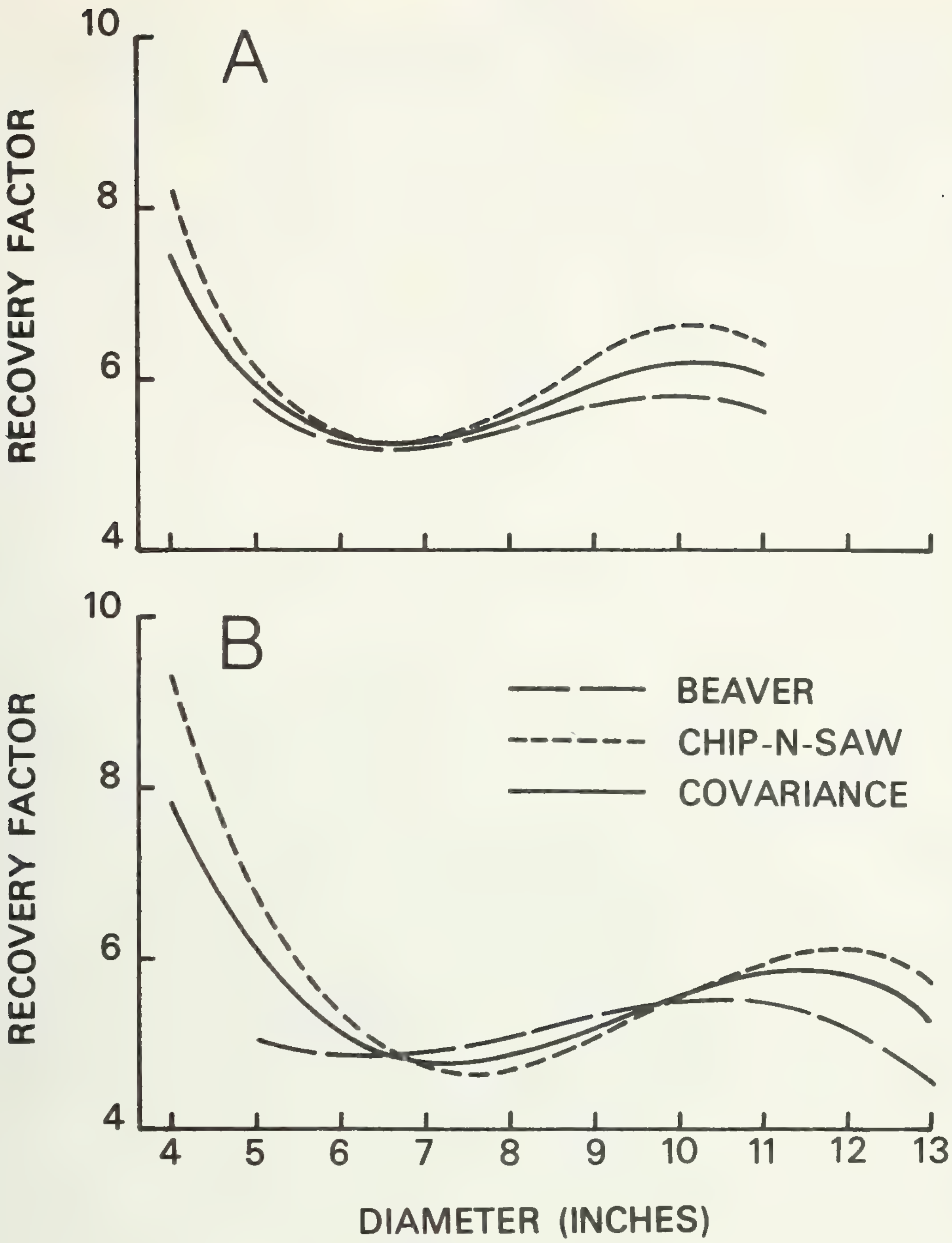

Figure 3.--Recovery factor, as a function of log diameter, by mill; A, Uniform Scaling Bureau measurement system, cubic scale; B, Forest Service measurement system, cubic scale.

CONCLUSIONS

What do the study results mean for the timber processor and the forest land manager?

The study has shown that new processing technologies in chipping mills can increase the stumpage value for small diameter timber. Most of the potential for increased stumpage value results from lower sawmilling costs which increase the dollar margin available to bid on stumpage. As more small diameter timber is placed on the market, additional small-log chipping mills may be constructed which in turn can increase competition and increase price of small-diameter stumpage. These higher stumpage prices for small diameter timber would increase the economic opportunity for forest management practices such as commercial thinning. Both shortrun and longrun competition for the timber resource should be considered in choosing a mill type. Even if there is little competition for small diameter timber at the present time, increased competition could result in substantially higher timber prices in the future.

At each mill, standard and better pricing rather than pricing by grade reduced the margin available to bid for stumpage. This finding further illustrates the link between the local processing industry and stumpage price. Price of small diameter stumpage in a local market area will depend on the specific markets for local mills' final products. Prospective end products to be manufactured from small diameter stumpage should be considered by both the land manager and timber purchaser when formulating stumpage price expectations.

Although the means used to measure log volume does not influence the intrinsic value of standing timber, this study has shown that the value per unit of log volume can vary substantially. If costs and returns from a stand of timber are evaluated on a per unit of log volume basis, both timber buyer and seller should be aware of the characteristics of the measurement system if a price reflecting intrinsic timber value is to be established.

Compared with the International 1/4-inch and Scribner Decimal C log rules, cubic volume measure was the most precise means of estimating lumber recovery for the sawmills and timber stands used in this study. For each log volume measure, accounting for log diameter reduced this coefficient of variation, but cubic volume measure without taking diameter into account had a lower coefficient of variation than either of the two board-foot measures with diameter taken into account.

LITERATURE CITED

Dobie, J.
1967. Chipper headrig productivity cuts small log milling costs. For. Ind. 94(9): 82-85, illus.

Fahey, Thomas D., and Douglas L. Hunt
1972. Lumber recovery from Douglas-fir thinnings at a bandmill and two chipping canters. USDA For. Serv. Res. Pap. PNW-131, 9 p. Pac. Northwest For. & Range Exp. Stn., Portland, Oreg.

Grosenbaugh, L. R.
1952. Shortcuts for cruisers and scalers. USDA For. Serv. South. For. Exp. Stn. Occas. Pap. 126, 24 p., illus.
Hamilton, Thomas E.
1971. Prices of primary manufacturing residues. For. Ind. 98(12): 25-26.
U.S. Bureau of Labor Statistics
Wholesale prices and price indexes. (Issued monthly.) U.S. Dep. Labor, Washington, D.C.
USDA Forest Service
1969. National Forest log scaling handbook. FSH 2409.11. U.S. Gov. Print. Off., Washington, D.C.

APPENDIX A

METHODS OF SCALING LOGS

The volume of the logs processed by the Beaver and the Chip-N-Saw was calculated in two ways: by the uniform Scaling Bureau procedure,[5/] and by the National Forest scaling handbook procedure (USDA Forest Service 1969). For each procedure, log scale was calculated for Scribner log rule, International 1/4-inch log rule, and cubic volume measure. This resulted in six combinations of measurement procedures and volume measures (table 7). Input by length and diameter class for logs scaled by the Forest Service procedure is shown in table 8, and by the Bureau procedure in table 9.

In the Bureau procedure, diameters were recorded with all fractional inches dropped. Since there were no logs longer than 42 feet, there is no taper allowance in the woods-length log scale for the Scribner log rule. For International 1/4-inch formula rule, there is a built-in taper allowance of 1 inch in 8 inches (Grosenbaugh 1952). The cubic log scale is based on diameter measurement of both ends, with volume estimated by Smalian's formula.

After the logs were bucked into mill lengths, they were rescaled by the Forest Service measurement procedure. Diameters were recorded to the nearest whole inch. For the Scribner scale, logs longer than 20 feet were extended as two pieces with a taper allowance as specified in the National Forest scaling handbook. International 1/4-inch rule and cubic scale were extended as one piece.

The International net scale was obtained by applying the percent of defect from the Scribner scale to the International gross scale on a log-by-log basis. No estimate was made for cubic defect.

5/ *Official log scaling and grading rules (revised as needed) used by log scaling and grading bureaus: Columbia River, Eugene, Oreg.; Puget Sound, Tacoma, Wash.; Grays Harbor, Hoquiam, Wash.; Southern Oregon, Roseburg; and Northern California, Arcata. Copies may be obtained from any of these bureaus.*

Table 7.--*Log scale by mill, measuring procedure, and volume predictor*

Measuring procedure	Volume predictor	Number of logs	Net log scale	
			Board feet	Recovery factor
	BEAVER			
Uniform Scaling Bureau	Scribner	205	8,360	1.41
Forest Service	Scribner	278	9,580	1.23
Uniform Scaling Bureau	International 1/4-inch	205	12,550	.94
Forest Service	International 1/4-inch	278	13,453	.88
Uniform Scaling Bureau	Cubic[1]	205	2,201[2]	5.37
Forest Service	Cubic[1]	278	2,300[2]	5.13
	CHIP-N-SAW			
Uniform Scaling Bureau	Scribner	169	7,510	1.43
Forest Service	Scribner	308	9,630	1.11
Uniform Scaling Bureau	International 1/4-inch	169	11,276	.95
Forest Service	International 1/4-inch	308	12,033	.89
Uniform Scaling Bureau	Cubic[1]	169	1,802[2]	5.95
Forest Service	Cubic[1]	308	2,003[2]	5.35

1/ Gross scale; no defect deductions were made.

2/ Cubic feet.

Table 8.--*Sample log input for two mills by length and diameter class, Forest Service handbook measurements, mill-length logs*

Mill and diameter class (inches)	Length of logs (feet)									Total
	10	12	14	16	18	20	22	24	26	
	Number of logs									
Beaver:										
5	0	1	1	16	1	15	0	8	0	42
6	0	2	1	3	1	31	0	29	3	70
7	0	0	1	1	1	26	0	7	0	36
8	0	0	2	1	2	32	1	5	1	44
9	0	1	0	0	0	34	2	6	0	43
10	0	2	1	1	0	18	1	4	0	27
11	0	1	0	1	0	10	0	0	0	12
12	0	0	0	0	0	3	0	0	0	3
13	0	0	0	0	0	1	0	0	0	1
Total	0	7	6	23	5	170	4	59	4	278
Chip-N-Saw:										
4	0	2	0	0	0	0	0	0	0	2
5	1	7	10	21	0	8	1	0	0	48
6	1	9	6	21	7	20	0	0	0	64
7	0	10	8	20	5	8	0	1	0	52
8	0	3	5	26	6	13	0	0	0	53
9	0	1	4	15	0	9	0	0	0	29
10	0	0	4	16	0	7	0	0	0	27
11	0	0	2	13	0	5	0	0	0	20
12	0	0	1	4	0	3	0	0	0	8
13	0	0	0	2	0	3	0	0	0	5
Total	2	32	40	138	18	76	1	1	0	308

Table 9.--*Sample log input for two mills by length and diameter class, uniform Scaling Bureau measurements, woods-length logs*

Mill and diameter class (inches)	Length of logs (feet)																	Total
	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	
	Number of logs																	
Beaver:																		
4	0	0	0	1	0	2	0	0	0	0	0	0	2	2	0	1	0	8
5	0	0	0	7	1	20	0	21	2	0	0	0	0	9	1	6	0	67
6	0	0	0	0	0	6	0	21	2	1	0	0	0	0	0	9	1	40
7	0	0	1	0	1	6	1	5	0	0	0	0	0	0	0	14	0	28
8	0	0	0	0	1	7	2	8	1	0	0	0	0	3	0	10	1	33
9	0	0	0	0	0	6	1	4	0	0	0	0	0	1	0	8	0	20
10	0	0	0	0	0	2	0	3	0	0	0	0	0	0	0	1	0	6
11	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	3
Total	0	0	1	8	3	52	4	62	5	1	0	0	2	15	1	49	2	205
Chip-N-Saw:																		
4	0	1	0	2	0	2	0	1	0	0	0	3	0	0	0	0	0	9
5	1	0	0	13	0	3	0	10	1	9	1	14	2	4	0	19	0	77
6	0	0	0	2	1	2	0	1	0	2	2	8	0	3	0	2	0	23
7	0	0	1	0	0	0	0	1	0	0	2	5	0	2	0	1	0	12
8	0	0	0	1	0	0	0	0	0	2	1	13	0	0	0	6	0	23
9	0	0	0	1	0	0	0	0	0	1	0	7	0	0	0	4	0	13
10	0	0	1	0	0	0	0	0	0	1	0	4	0	0	0	1	0	7
11	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	2	0	5
Total	1	1	2	19	1	7	0	13	1	15	6	57	2	9	0	35	0	169

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The mission of the PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION is to provide the knowledge, technology, and alternatives for present and future protection, management, and use of forest, range, and related environments.

Within this overall mission, the Station conducts and stimulates research to facilitate and to accelerate progress toward the following goals:

1. Providing safe and efficient technology for inventory, protection, and use of resources.
2. Development and evaluation of alternative methods and levels of resource management.
3. Achievement of optimum sustained resource productivity consistent with maintaining a high quality forest environment.

The area of research encompasses Oregon, Washington, Alaska, and, in some cases, California, Hawaii, the Western States, and the Nation. Results of the research will be made available promptly. Project headquarters are at:

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